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SIMPLIFIED SO AS TO BE COMPREHENSIBLE TO THE MOST MODERATE CAPACITY.

BY GEORGE PYNE,

AUTHOR OF 'PRACTICAL RULES IN DRAWING FOR THE OPERATIVE BUILDER AND YOUNG STUDENT IN ARCHITECTURE.'

PARTS I. II.

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M.DCCC.XLVIII.

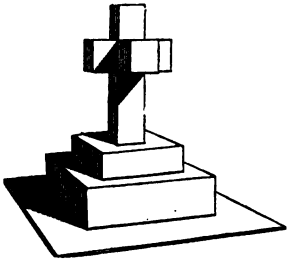
INTRODUCTION.

In the course of twenty years' extensive practice as a teacher of drawing, the author has frequently had considerable difficulty in making his juvenile pupils comprehend the necessity for and the value of a knowledge of Perspective. Many works have appeared, proposing to enable the student and the amateur to instruct themselves in this indispensable branch of the Art of Painting, but the author has never yet met with one that has appeared to him well calculated to accomplish so desirable an end. To furnish amateurs, and especially young ladies, with the means to acquire, by themselves, a sufficient knowledge of Perspective, as will enable them to make agreeable sketches from nature, without sacrificing too much of that time that must be required for other occupations, has been the object of the author. In the little work he now puts before the public, his principal endeavour has been to avoid

every possible difficulty—every superfluous line. It is addressed to those only who require but a limited knowledge of Perspective; sufficient to enable them to avoid committing any of those gross errors, so constantly to be observed in the works of those entirely ignorant of it. He strongly advises all desirous of drawing from nature to make themselves masters of the modes here given for drawing various forms, so as to be able to apply them mentally in sketching from nature. It is universally admitted, that sketches made by those who draw by their eye, having at the same time a thorough knowledge of Perspective, produce more agreeable paintings than those who draw entirely by rule. To demonstrate to the juvenile student the value of a knowledge of Perspective, let him examine the cut at the end of this introduction, as also that at the end of the work. The first is a correct representation of a double cross in perspective, drawn, as it would appear, when quite new and perfect; the latter (which is drawn over the same outline) is intended to represent a similar cross in an ancient and dilapidated state. The student will perceive that the perspective drawing looks formal and uninteresting, while the other has an agreeable and picturesque

appearance, though perfectly correct. The art of painting is to represent objects in nature as they appear to the eye; but if any lines, either from time or accident, have lost their perpendicular or horizontal direction, great care should be taken in the representation of them, that they are so drawn as not to appear like faulty Perspective, but as the result of time or some other cause. It is the absence of formality that constitutes picturesque form.

Paris, June, 1846.



CONTENTS.

PERSPECTIVE

FOR

STUDENTS.

PART I.

STUDENTS, from the first commencement of drawing, should never neglect an opportunity of submitting their productions to the inspection of those who, from their superior knowledge, may point out defects, and suggest alterations extremely useful. But in criticising their works, those who have attained some proficiency may frequently make use of terms which, though perfectly correct, may by possibility not be understood by very young pupils, and hence they may lose much valuable assistance.

Before commencing Perspective, the pupil will therefore find it to his advantage to make himself acquainted with the following preliminary matters, which more properly belong to practical geometry.

Many young persons, in copying a drawing, if they draw a line that is out of the perpendicular, or not horizontal, are apt to say, "That line is not straight." The first thing to comprehend is, that all lines lying evenly between their two extremities (which are called points) are straight lines, whatever direction they may take (*fig.* 1.). The line A B is a straight line, and each of the lines that run from it and through it are also straight lines, although they vary in their direction.

Lines that run in the same direction, and continue always at the same distance from each other, are called parallel lines (*fig.* 2.). Lines which incline towards each, and meet in a point, are said to form angles. Angles have three different names, according to the space contained between the two lines at an equal distance from their point of meeting (*fig.* 3.). The lines A E and C E meet together at the point E; the lines B E and C E also meet together at the point E: the space between A C and the space between B C will be found to be exactly equal. Whenever one line stands upon another line, and upon drawing a semicircle from the point of contact (as the semicircle A C B, drawn from the point E), the line divides the semicircle into

two equal parts, it is said to be perpendicular* to the line on which it rests, and the angle on either side is called a right angle. If the space contained between two lines forming an angle be less than that contained between the lines forming a right angle, the two lines are said to form an acute angle. The angle formed by the lines D E and B E is less than the right angle, because the space contained between B D is less than the space contained between C B: for the same reason the lines C E and D E also form an acute angle. If the space contained between the two lines be greater than the space contained between the two lines that form the right angle, the two lines are said to form an obtuse angle. The angle formed by the lines A E and D E is greater than the right angle, because the space contained between A D is larger than the space contained between A C. If

* It is a common error to confound the terms vertical and perpendicular. One line is always said to be perpendicular to another line when the angle formed by the two lines is a right angle. Vertical lines are those lines perpendicular to the horizon, or to the surface of the globe. If a vessel lie on the surface of the water in a dead calm, having her masts perpendicular to her deck, the masts may be said to be vertical; but if the water were agitated so as to throw the vessel at an angle with the horizon, though the masts would still be perpendicular to the deck, they would no longer be vertical lines.

the learner open a pair of compasses exactly half way, the legs of the compasses will form a right angle; if they are shut-to a little they then form an acute angle; if opened a little wider they form an obtuse angle. If the extremities of the two lines forming an angle are joined by a third line, the figure formed by the three lines is called a triangle, from its containing three angles (*fig.* 4.).

In making perspective drawings certain instruments are indispensable; and one of the most essential is a proper drawing board, in the choice of which great care should be taken that the edge at the bottom be perfectly straight, and that at all events one of the sides be perfectly at right angles with the line of the bottom, or, in other words, that the side of the board be perpendicular to the bottom: if not, and the pupil should make use of the T square*, his

* The tee, or, as it is commonly written, from its form, T square, is a ruler to which is attached at one end a cross piece of wood; and this cross piece, being made thicker than the ruler itself, enables the draftsman to slide it backwards and forwards on the edge of his board. The ruler attached to this cross piece is exactly at right angles with it; and consequently, in moving it along the bottom edge of the board, and drawing lines from it, the lines must all be parallel to each other, and perpendicular to the bottom line of the board. Now if the drawing board have

drawing can never be correct; because all lines drawn with the T square are parallel: consequently, whatever error may exist in the drawing board will be multiplied by your ruler. To be certain that you commence with a perpendicular line, draw, as in the following example (*fig.* 5.), with a ruler, a straight line, which is to form the bottom, or base line, of your picture. From the point on this line from which your perpendicular line is to be raised, as at A, mark off an equal space on each side, as the spaces A B and A C, from the extremity of each of these spaces at the points B and C, with a pair of compasses, at an extension of not less than once-and-a-half the length of A B or A C; describe two portions or arcs of a circle immediately over the point A; from the point D, where these two arcs intersect each other, draw the line D A, which will always be perpendicular to the line A B, and may be continued to any length. The learner must be aware that in a

one of its sides at right angles with the bottom edge, by shifting the T square from the bottom to the side of the board, and sliding it on this edge, all the lines ruled from it will be parallel to each other, and at right angles with the lines drawn from the bottom. The T square is the most convenient and quickest ruler for drawing all perpendicular and horizontal lines.

work of this kind, illustrated by wood-cuts, the space for the insertion of the examples is extremely limited: he is therefore recommended, in drawing them for his own practice and improvement, to enlarge them very considerably—say from four to six times the size.

There are various other rules in practical geometry that the author has found useful to his pupils; but as this is not a treatise on practical geometry they are not given. The foregoing are introduced from a conviction that with the very young they are nearly, if not quite, indispensable.

In introducing my young readers to an elementary knowledge of perspective, as the most simple definition, I should say that perspective is the art of representing objects at various distances, and is of two kinds — Ærial Perspective, and Linear Perspective. Ærial Perspective is the art of giving the appearance of distance, independent of lines. Claude de Lorraine is celebrated for his exquisite manner of representing ærial perspective: many English painters are also highly and deservedly celebrated for this portion of the art of painting, more particularly the painters in water-colours; among whom, perhaps, Glover and Copley Fielding have been the most successful. It is of the latter, linear perspective, that we have to

treat: of this it may be said, that it is the art of drawing outlines of objects from nature, of their relative sizes according to their distance, as they would appear in looking through a sheet of glass placed between them and the object. The reader is doubtless aware that all objects of the same magnitude apparently diminish as they recede from the eye of the spectator. In walking in a long street at night, the reader must have noticed the appearance of the gas-lamps as they gradually recede from him: if the street be very long they will appear to come closer and closer together, till they apparently meet in a point; yet the more distant lamps are as far apart from each other as those close to the spectator. The same appearance is observable in a long avenue of trees. In a long series of arches, the first few will show their curves wide and distinct: as they recede from the eye they appear gradually narrower and narrower, till in the extreme distance they assume the appearance of mere straight lines. To demonstrate clearly to the young reader that objects at a great distance seem very small, let him look through a pane of glass, and imagine that this pane of glass were a sheet of paper, on which he had to represent all the objects he sees through it: though

this pane of glass may only be a foot square, he may see houses, ships, tracts of country, mountains, rivers, &c. &c., represented on this small space, though perfectly aware of their actual size.

Most of my readers must have heard the term *horizon* frequently used in conversation—in such cases as "the sun is above the horizon," or, "the sun has sunk below the horizon," &c. &c. Every perspective drawing has a line running across it, parallel to the bottom of the picture, to designate the line of the horizon, which line is called the horizontal line. In drawing from nature this line is at a height exactly level with the eye of the draftsman, and its position, or distance from the base of the picture, which is called the ground line, depends entirely on the position in which the artist places himself to take his sketch. In the following example (*fig.* 6.) we will suppose the lines 1, 2, 3, 4, to form the boundary lines of the picture. If the draftsman is placed in a sitting posture, as at A, the horizontal line will be at the height of the line 5, even with the painter's eye, and parallel to the ground line 1. If the draftsman stand up to take his sketch, as at B, the horizontal line will be higher, in consequence of his eyes being in a more elevated situation, and will be at the line 6. If to

get into his picture some more distant object the artist should find it necessary to raise himself still higher, as at C, upon the bank, the horizontal line will also be raised, as seen by the line 7, or, as I have before stated, the height of the horizontal line depends on the raised or lowered position of the eye of the artist.

In making a picture, the choice of height of the horizontal line is of considerable importance. To make the horizontal line exactly half-way between the top and bottom of the picture has generally a bad effect; it appears to cut the picture in half, and the perspective is not pleasing to the eye. It is generally considered that the most agreeable perspective is produced by placing the horizontal line at about one-third the height of the picture from the ground line: to place it lower than this is generally preferable to placing it higher. There are painters, however, of great celebrity, who in some of their finest productions have placed their horizon so high as to be removed only one third from the top of the picture. Gaspard Poussin, Francesca Mola, Domenichino, &c., have frequently painted pictures with these high horizons; but the subjects are peculiar, and the painters so talented, that anything emanating

from their pencils cannot fail to be good. All those views that come under the denomination of bird's-eye views must necessarily have the horizontal line very high, being taken always from some high window, tower, or eminence of some sort, such as the views of London from St. Paul's, of Paris from the Pantheon, &c. &c.; but such views are intended more for topographical curiosities than for pictorial representations.

In order to give the reader an idea of the use of perspective, we will commence with some object of the most simple form—a square, or oblong (figures which are technically called rectangular parallelograms, from their opposite sides being parallel to each other, and the angles all right angles). Let the student take any rectangular object—a work-box, for instance; let him place it in front of him, close to his feet, then bend his head slightly forward till his eyes come immediately over the centre of the box (*fig.* 7.): so placed, he will be able to see nothing but the simple form of the lid, it being impossible in this position to see either the front, back, or sides. Let the student now place the box on the chimney-piece, the front towards him, and place himself about two yards from it, and in such a position that his eyes shall come on a level with the

middle of the front of the box, and exactly midway between its two sides (*fig.* 8.): thus placed, the student will see nothing but the front of the box, it being impossible in this position to see either the top or sides. The student must now place the box on a chair or other support, so as to be in height about halfway between his head and feet, placing himself at two or three yards' distance from the object, but still in such a position that his eyes are exactly opposite the key-hole of the box (*fig.* 9.): he now, from the changed position, sees the top and front of the box. Let the student now shift his position about one yard to the right, leaving the box in the same situation: he will here find that he sees the front, the top, and one side of the box. (*fig.* 10.) The student will here observe, that according to the variation of the position from which he regards the object it changes its apparent form. In the first two figures he will see that the lines are all parallel to their opposites, or, as it is commonly called, are in geometrical drawing; but in the third figure he will perceive that the lines of the sides of the top converge, and that the line of the top of the box at the back is shorter than the line of the top in front. Perspective teaches how to find the proper directions

for these converging lines, and also shows how to regulate the length of the line at the back of the box, so as to make it agree with its apparent diminution of size to the visual organs. The same remarks apply equally to the last figure.

As another example of the use of perspective, let the student procure a common bowl, and place it at his feet, looking at it in a similar manner as at the work-box in its first situation. In looking at it in this position the student will see nothing to draw but a plain circle. (*fig.* 11.) If the bowl be placed on a chair, as the work-box in its third situation, the spectator being in the same relative position, the circular opening of the bowl appears of only half its width, and a portion of its outer part is seen. (*fig.* 12.) If the bowl be now placed on the chimney-piece, and the eye of the spectator brought to a level with the upper edge of the bowl, none of the inside of the bowl is perceptible, the circle from this point of view appearing as a straight line. (*fig.* 14.) The student will here observe that, according to the position in which the spectator is placed relatively to a circular object, it takes the form of a circle, an ellipse, or a straight line. Perspective teaches how to delineate the form the circle

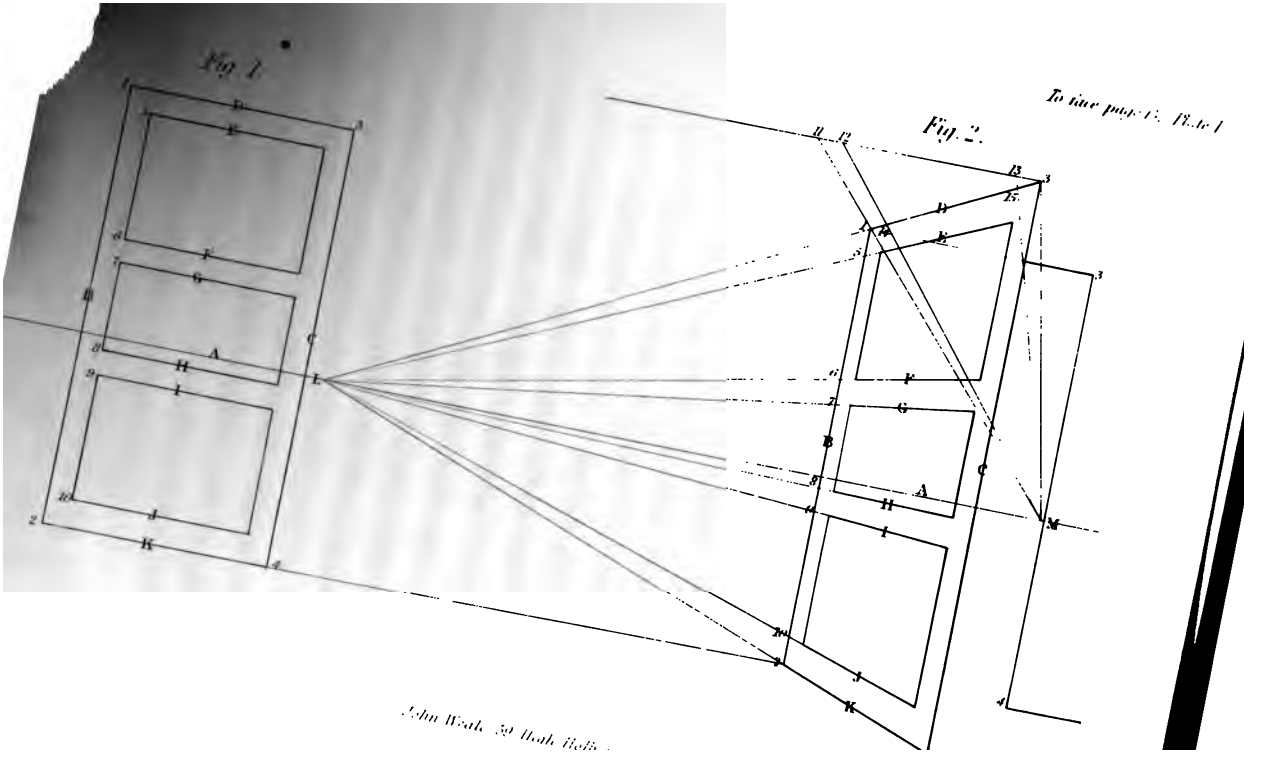


Fig. 1.
Fig. 2.
To face page 13. Plate I
John Weale, 59 High Holb

takes, according to the point of view from which it is seen.

It is to be presumed, that before commencing the study of perspective the student has already dabbled a little in drawing; in which case he must now make an attempt to draw a little perspective for himself. Let him place himself in a chair, immediately opposite a closed door, and at a distance of six to eight feet, and in that position let him draw the door, and the cornice, if any; if not, let him sketch a little of the pattern of the papering above the door, as in *fig.* 1. Plate I., which is a geometrical drawing of a door, to be put in perspective.

Let the student now imagine a straight line passing directly from his eye to the door, always at the same height from the floor, or, more correctly speaking, parallel to the floor: this line would touch the door at the point A; and this point fixes the height of the horizontal line, and is called the point of sight. But we must here proceed with the second figure, Plate I.

The student must first draw the four outer lines of the door, as in the geometrical drawing, and then through the point A (the height of his eye from the ground) draw a line across his picture

parallel to the ground line, or bottom line of the drawing: this is the horizontal line. In looking at the geometrical drawing (*fig.* 1.) it will be seen that the two lines B C, which represent the two sides of the door, from each of them being at the same distance from the eye of the spectator, are of an equal length; that the lines D and K, representing the top and bottom lines of the door, are parallel to each other, and that the lines representing the top and bottom of the panels are parallel to each other, and to the lines D and K also. Let the student now open the door about one foot: here he will observe an extraordinary difference;— the directions of all the horizontal lines*, as seen in the geometrical drawing, are now changed. Observe that the upper and lower corners of the door, 1 and 2, the side where the hinges are fixed, remain the same as in the geometrical drawing: it has not changed its situation, but the corner 3 is raised, and the corner 4 lowered, making the side C of the

* All lines in a drawing that are parallel to the horizontal line are called horizontal. The student must understand that the line drawn through the point A is *the* horizontal line, or line representing the horizon; and that those lines parallel to it are only called horizontal in reference to their being parallel to it.

door longer. The side of the door C, from its being approached nearer the eye, becomes apparently larger; but the side B, as it remains in precisely the same position, remains of the same size as in the geometrical drawing. The student must now carefully notice at what particular spot on the cornice, or at what particular mark on the pattern of the papering, the point 3, marking the top of the door, appears to touch and mark the spot on his drawing: from this point, through the point 1, marking the other corner of the top of the door, the student must draw a line till it touch the horizontal line, and the point L, where it touches, is called the vanishing point. Now the student must bear in mind, that this vanishing point is the point to which every line of the door parallel to the line of the top of the door in the geometrical drawing must be drawn in his perspective drawing, whether above or below the horizontal line. In order to get the perspective line of the bottom of the door, the student must place his ruler to the vanishing point 4, and draw a line through the point 2 till it passes nearly under the right-hand side of the door: to determine the length of this line, the student must draw a perpendicular line from the point 3 till it meets at the point 4. The student should

now with a firm hand draw over the lines B, C, D, K, to make them stronger than the other lines; and he will then have the external lines of the door in perspective, as it appears to him from the position in which he is placed. The next thing necessary is to find the perspective inclinations of the lines forming the top and the bottom of the panels of the door — the lines E, F, G, H, I, J, of the geometrical drawing. To accomplish this the student must mark upon the line B the relative distances of these lines, as at the points 5, 6, 7, 8, 9, 10, and from the vanishing point L through each of these points he must draw a line till it touch the line C. Here, then, are all the horizontal lines of the panels of the door in their perspective directions: and the student will observe that the panels of the door, as also the frame-work of the panels, gradually widen as they approach the eye of the spectator, or, in other words, they diminish as they recede from it. Having obtained the lines which will regulate the height of the panels, it is now necessary to determine their width. It must be obvious to the reader, from what has already been said, that the frame-work surrounding the panels must be wider on the side nearest to him than on the side at the greater distance. To

find the width of the panels the student must draw a line parallel to the horizontal line from the point 3 of the geometrical length of the top of the door, and measure off with his compasses from each extremity, 3 and 11, a space equal to the width of the frame-work of the panels, as at 12 and 13, the space between being obviously the width of the panel. From the point 11, passing through the point 1, a line must be drawn till it touch the horizontal line, as at M; and this point is called the point of distance, and regulates the width of all the spaces between the perpendicular lines upon the door. From the points 12 and 13 two lines must be drawn to the point of distance, M; and where these lines intersect the line D, at 14 and 15, they mark the perspective width of the frame-work or panels on the top of the door: from these two points, 14 and 15, two perpendicular lines must be drawn till they touch the line K; and where these perpendicular lines pass between the lines E and F, G and H, and I and J, they form the perpendicular boundaries of the panels. The student must now strengthen all the lines of the panels, as in the example; and he has completed his task,—he has drawn the door in perspective.

In order to make the foregoing example simple

enough to be comprehensible to the most inexperienced, the drawing is confined to the fewest possible quantity of lines. The thickness of the door and the projection of the frame-work round the panels has been purposely omitted,—a multiplicity of lines tending always to perplex the learner; but the rules for drawing these are the same as those already explained. That the student may satisfy himself that he has clearly understood what he has just accomplished, let him open the door so wide as to bring the handle of the door within a foot of the wall, and re-seat himself in the same position. He now loses sight entirely of the side of the door he has just drawn, and the outer side becomes visible. The point of sight, and consequently the horizontal line, is precisely the same, but the vanishing point of the door changes sides: instead of being to the left of the artist, it is now to his right hand; the whole drawing of the door is reversed, but the process of putting it in perspective is precisely similar to that of the last example. It is strongly recommended to the student to proceed carefully and steadily to draw it in this altered position.

PART II.

THE Author, when very young, on being strongly recommended by an artist, now an R. A., to draw from nature, replied, that he had no possibility of getting into the country. "My young friend," said Mr. C——, "you have got a notion, like many other foolish people, that to draw from nature it is necessary to go into the country. Let me advise you, if you cannot find a tree to draw from, to draw the plants in your mother's flower-pots; if you cannot get to draw the outside of a house, draw the inside of a room; if you are unable to find a wheelbarrow, take a coalscuttle; if cows and sheep are not to be found, draw the family cat;—you will find it equally improving, and it will give you the power ultimately of representing every object you desire on paper." The advice was most excellent; and the Author most strongly recommends it to his juvenile readers. He is about to lead them step by step to draw various objects in perspective; and the forms selected will be the most familiar and the best adapted to the purpose: but in the limits of a small work like this the

principles on which certain objects may be represented in drawing is all that is attempted. If an example of a square object is given, the rules for drawing that square object will apply to every thing of a similar form seen from a similar point of view. If an example is given for drawing a circular, octagonal, or, in fact, any other form, all similar forms may be drawn by the same rules. Once clearly comprehend how to draw a circle in perspective, and it is immaterial what circular object is to be represented: the same rules apply to all, whether a plate, a tumbler, a column, or a dial, &c.

One of the great difficulties experienced by teachers is that of making their pupils understand the manner of finding their points. For architectural draftsmen, and those who go deeply into perspective, there are rules by which all the various points are to be found; but they are perplexing and tedious, unfitted for an elementary work like this, and totally unnecessary for those whose object is simply to acquire that knowledge of perspective which will enable them to make correct and agreeable sketches from nature. In order to find the vanishing points, some teachers recommend their pupils to make use of an instrument called a moveable angle, or guiding

To face

Fig. 4.

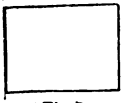


Fig. 7.

Fig. 8.

Fig

Fig. 13.

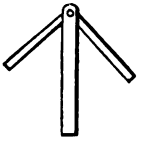


Fig. 14.

Fig. 19.

Fig. 20.

rule. It is an instrument of this form. (*fig.* 14.) It is made simply of three straight pieces of wood, the two outer pieces of which, by means of a moveable screw, open and shut like a pair of compasses. The use of it is, to hold it at arm's length, between the spectator and the object to be represented, as, for instance, the two top lines of a church tower, and by means of the screw move the legs of the guiding-rule till they follow the direction of the inclination of these two upper lines; then laying the guiding-rule on your paper, and placing the point formed by the angle over the point representing the highest point of the nearest corner of the tower, rule the lines in the direction of the two sides of the guiding-rule, and continue them till they touch the horizontal line. The points where these lines would touch would form the vanishing points for the horizontal lines on the respective sides of the tower.

Presuming that the reader draws a little before attempting to draw from nature (and if not, he is strongly recommended so to do), the Author considers it far preferable for the draftsman to depend rather on his eye and judgment than to make use of a guiding-rule or other mechanical instrument; that

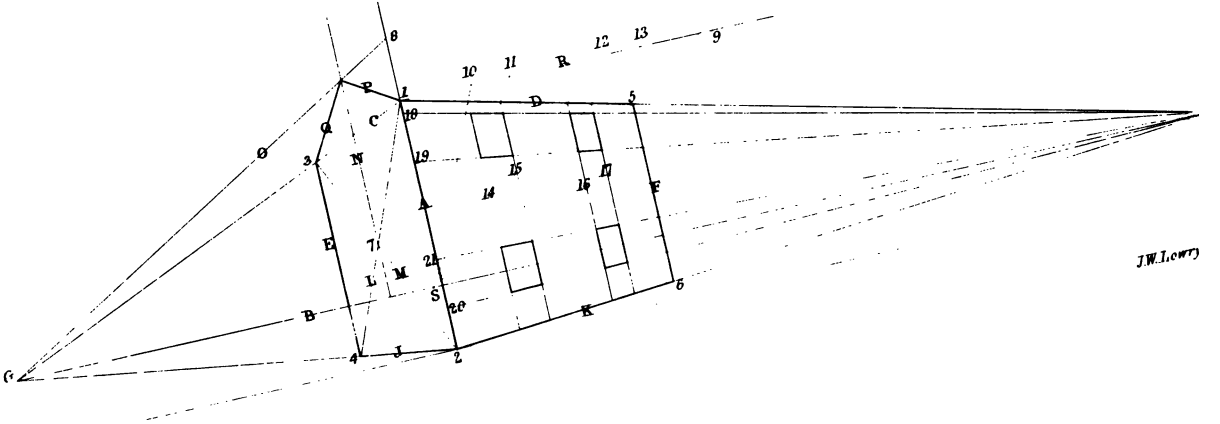
he make his first sketch by eye, and correct it afterwards by the rules of perspective.

Problem I.

Let the student imagine himself placed before a cottage, having a gable at one end and four windows in front, and let him further imagine that he is so situated as to see both sides nearly equal—that he stands, in fact, nearly in a line running from the angle formed by the lines J K to the corresponding corner, which is hidden. (*fig.* 15.) Suppose A to be the plan of the house, and B the position of the draftsman, C would represent the line drawn from the spectator's eye to the point of sight: and the student will perceive that the lines D and E, the two sides of the house visible, are neither of them in the direction of this line C; consequently that the point of sight cannot form the vanishing point for any lines running parallel to either D or E; and that as these two lines are also at an angle, each of them must have its respective vanishing point: the line D will have its vanishing point to the right, and the line E to the left.

The student, if sketching from nature, must first

Prob. 1.



Weale, 59, High Holborn. 1846.

draw, according to the best of his judgment, the first upright line, A, of the building, and set a mark upon it at the height of his eye, in order to get the horizontal line. To make this perfectly simple we will suppose the real height of this line to be twenty feet, and that the spectator is so situated as to have his eye at five feet from the ground: he must then measure off from the bottom of the line one-fourth of its length, which will give the height of his eye at five feet from the ground, and through this point he must draw a line, B, across the picture, which will form the horizontal line.* From the top of the line

* The student must here bear in mind that the height of the horizontal line depends entirely on the situation in which he is placed. If the building from which he is drawing stood on a rising ground, say a rise only of five feet, the horizontal line would be exactly on a line with the base of the building, the spectator's eye being supposed five feet from the ground on which he stands. If, on the contrary, the *spectator* stood on a rise of five feet, the horizontal line would cut the line A in half, because, the house being twenty feet, the spectator's eye being five feet above the spot on which he stands, would bring it to ten feet high. If the spectator stood on a rise of fifteen feet the horizontal line would be on a level with the top of the house. Practice, and attentive examination of the works of clever artists, will gradually teach the amateur a good choice of position, upon which the agreeableness of his drawing greatly depends.

A the student must now sketch the line C and D, marking their inclination towards the horizontal line as carefully as possible, and he must then sketch the lines E and F to determine the width of the two sides of the building. This is all that is necessary for the student to draw by eye, and he must now correct his sketch by rule. He must first, with his T square, the use of which has been already described, make the line A perpendicular, so as to be at right angles with the horizontal line on each side, both above and below it: he must then, placing his rule upon the top of the line A, marked 1, in the direction he has sketched the line C, rule a line till it meet the horizontal line at G, which will be the vanishing point for all the horizontal lines on the left side of the house. From the same point 1, the top of the line A, following the direction of the sketched line D, another line must be drawn till it meet the horizontal line at the point H, which will be the vanishing point for all horizontal lines on the right side of the house. The rule must now be placed at the point 2, the bottom of the line A, and from it to the vanishing points, G and H; the lines J and K must be drawn, which lines represent the perspective inclination of the bottom lines of the house as the

lines C and D represent the perspective inclinations of the top lines. The lines E and F, determining the width of the two sides of the house, must now be corrected by the T square, taking care to draw the line E so as exactly to meet the lines C and J at the points 3 and 4, and the line F so as exactly to touch the lines D and K at the points 5 and 6. Here let the student well notice these three lines, A, E, and F, which, though really of the same height in nature, are all dissimilar in the perspective drawing. The line A, from being the nearest to him, appears the longest; the line E, from the left side of the house being narrower than the right, is nearer to the spectator than the line F, and is consequently, though considerably shorter than the line A, much longer than F, the farthest removed from the eye.

The upper part of the left side of the house is terminated by a pointed roof, or what is called a gable, and the point of this gable in nature is perpendicularly over a point midway between the lines A and E. The student must be aware that the *perspective* centre of the side of the building cannot be exactly halfway between the lines A and E in the drawing, because that half of the building nearest to him must appear wider than the half that is farther

off. If the centre is required of any rectangular parallelogram, it is got by ruling two lines from its opposite angles, which are called diagonal lines (*fig.* 16.), the intersection of which denote the centre of the figure. So in perspective,—the space contained by the lines A, C, E, J, is a rectangular parallelogram in perspective; and if from the opposite points, where these lines join, as from 4 to 1 and from 3 to 2, the diagonal lines L and M are drawn, the point where they intersect at 7 is its perspective centre*, and the point of the gable must be drawn directly over it, to do which the student must draw a perpendicular line N through this point 7 above the line C, and at some point on this line the lines forming the sides of the gable must meet. In order to determine the height of the point of the gable the student must continue the line A above the point 1. This line, being the nearest perpendicular line, is the most convenient for finding the height of all objects on either side of the house. Let us suppose the height of the

* This mode of finding the perspective centre of a parallelogram by diagonal lines is eminently useful in sketching from ature; it often obviates the necessity of a great many points and lines that would otherwise be needed. The student will do well to bear it in mind.

point of the gable to be five feet above the line C; this five feet must be set upon the line A, above the point 1. The student must therefore put on this line one-fourth of its length, as at 8, and from it (the point 8) rule a line O to the vanishing point G; and where this line intersects the line N is the perspective position of the point of the gable, to which, from the points 1 and 3, draw the lines P and Q, which complete the drawing of the left side of the building.

The student is here shown the method of finding the exact perspective height of the point of the gable; but in sketching from nature it is quite sufficient to choose the point on the line N by the eye, and from it rule the lines P and Q,—as whether it is a trifle higher or lower is of little importance.

The mode used for finding the position and width of the windows is similar to that used for drawing the door, in the introduction. From the point 1 a horizontal line R must be drawn, to represent the geometrical length of the line D in the perspective drawing*; and on this line must be measured off at

* It is immaterial to what length the line R is drawn, so that it be longer than the line D. The student must be aware that R, being the geometrical line represented in perspective by the line D, must necessarily be the longest. If the line

each end the distance of each window from the side of the house, as at 10 and 13, and from each of these points the width of each window, as at 11 and 12. From 9, the extremity of this line R, a line must be drawn through the point 5, till it meet the horizontal line at S, which point forms the point of distance, by which the width of all objects on the right side of the house is determined. From each of the points on the line R, viz. 10, 11, 12, 13, a line must be drawn to the point of distance, S; and where these lines intersect the line D (which represents R in perspective) they designate the perspective positions of these points, from each of which a perpendicular line, as 14, 15, 16, 17, must be drawn, till it touch the bottom line, K, of the building. The space between A and 14 represents the perspective distance between the side of the house and the first window; that between 14 and 15 the perspective width of the first window; from 15 to 16 is the perspective width of the space between the two windows; from 16 to 17 the perspective width

R were lengthened so as to bring the point 9 further to the right, but keeping the distances and width of the windows in their relative proportions, the point of distance would be further to the left, but the intersections on the line D would be the same.

of the second window; and from 17 to the line F the perspective width of the space between the last window and the farther side of the house. It now only remains to determine the height of the windows, and their respective distances from the top and bottom lines of the building. Let us suppose that the upper window is one foot below the line D, and that the window is four feet high; a twentieth part (one foot) must be marked off on the line A below 1, as at 18, which will be the geometrical distance of the top of the window from the roof, and below this one-fifth of the line A (four feet), as at 19, which will be the geometrical height of the windows, and from each of these points a line must be drawn to the vanishing point H. Where the line drawn from 18 passes between the lines 14 and 15, and 16 and 17, it gives the perspective drawing of the top of each of the upper windows; and where the line drawn from 19 passes between the same lines, 14, 15, and 16, 17, it gives the perspective drawing of the bottom lines of the upper windows. Supposing the lower windows to be of the same height as the upper ones, and that they are three feet from the ground, these distances must be placed on the line A; that is to say, from the bottom, 2, of the line A must be set up three-

twentieths of its length (three feet), as at 20, and above that one-fourth of the length of A (four feet), as at 21. From each of these points, 20, 21, a line must be drawn to the vanishing point H; and where these lines pass between the lines 14, 15, and 16, 17, they give the perspective drawing of the top and bottom lines of the lower windows.*

It is hardly necessary to tell the student that the dark lines in the plates represent only the object to be drawn, and that the faint lines are those used for finding the correct perspective. In the foregoing example, on the right side of the drawing, the student is made to comprehend a mode for finding the perspective distance and size of any object on the face of a building: the forms chosen—the windows—are rectangular figures, as being the most simple; but the position and size of any object, whatever may be its form, can be ascertained by the same rule. In our progress we shall endeavour to render intelligible the mode of putting a variety of forms into perspective; but, like every thing else, it is necessary to

* The student should now draw in with a pen the strong lines, leaving the remaining lines, as well as the letters and figures, in pencil, and carefully preserve his drawings, as he will find them always useful, and towards the end of the work they may save him much time and labour.

proceed step by step, and to thoroughly understand one problem before proceeding to another.

On the left side of the problem the student is made to comprehend a mode for putting a pointed roof or gable in perspective; and, simple as it is, it is surprising the number of errors constantly committed by the neglect of its use. The author has seen many paintings where the artist, from mere carelessness, has brought the point of the gable nearer to the line represented by A than to the side represented by F, which is most offensive to the eye. Many of the Dutch and Flemish paintings show a great deficiency in perspective drawing; and the great Teniers, notwithstanding his beautiful representations of still-life, sadly outrages perspective in some of his out-of-door scenes.*

Problem II.

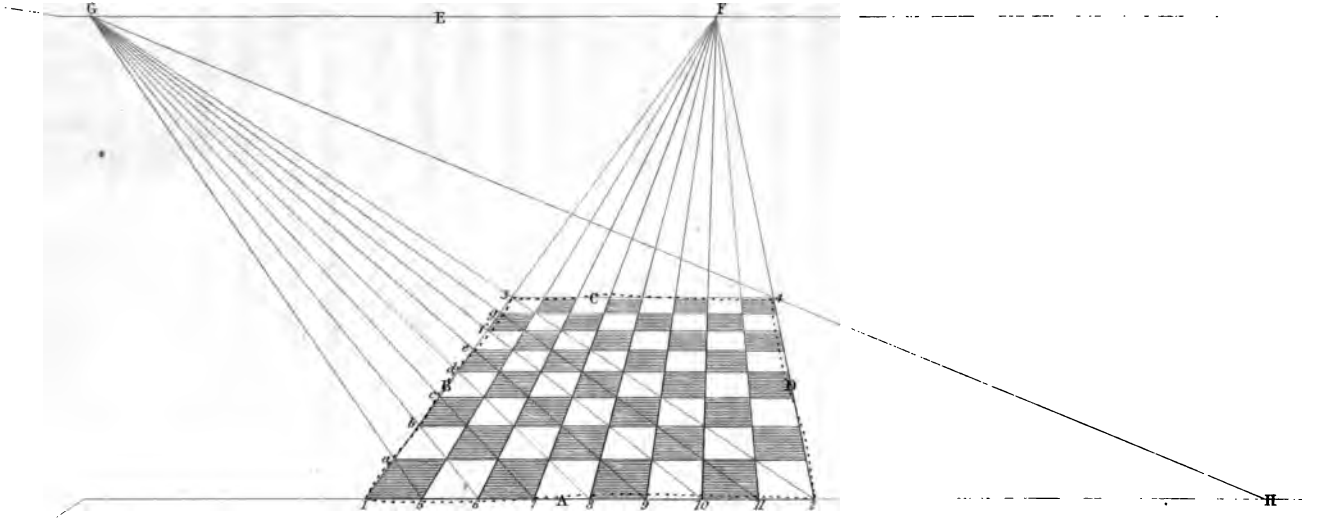
In the foregoing example, the mode for finding a point of distance is given upon a line above the hori-

* There is an entertaining print by Hogarth, the title of which I do not recollect, that would amuse, and at the same time be useful to, the young reader: in it he has outraged perspective as much as possible. The student would do well to examine it and find out its errors.

zontal line: but many instances occur in drawing perspective where all the lines are below the horizon; as, for instance, a chess-board placed on a table, where, even in a sitting position, every line must be below the eye, or the squares on it could not be seen. The student should place a chess-board before him, so as to view it in the same position as that represented in the plate. He must first sketch, to the best of his judgment, the square of the board A, B, C, D.* The line A must be drawn over with a rule, to make it perfectly straight; and parallel to it, at the distance the eye is above the board, a long line, E, must be drawn across the picture to represent the horizontal line. From the point 1 — the nearest left-hand corner — in the direction of the sketched line B, draw a line till it touch the horizontal line E at F, which will be the vanishing point. From the point 2 — the nearest right-hand corner of the board — a line must also be drawn to the vanishing point F. These two lines, B and D, represent the perspective inclinations towards the vanishing point of

* The dotted lines represent a sketch of the square of the chess-board, as it might be made by a beginner, to show with what facility a very indifferent sketch may be corrected by rule.

Prob. 2.



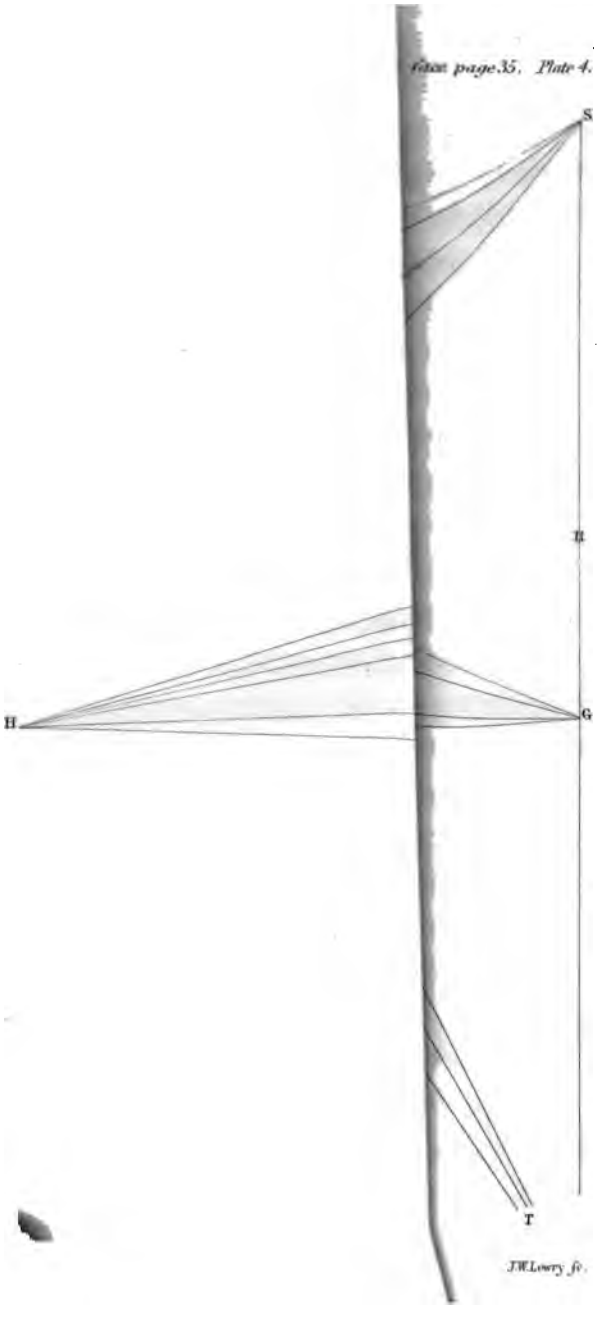
J.W.Lowry fc.

the two sides of the chess-board; and the student will perceive how easily the two sketched lines are corrected. At the distance of from A to C, and parallel to A, a line must be drawn between B and D, to touch them at the points 3 and 4. The lines A, B, C, D represent the outer lines of the chess-board in perspective. In order to regulate the perspective widths of the squares, which gradually diminish from the line A to C, it is necessary to find a point of distance. The chess-board being a square, the student will understand that the line B, between 1 and 3, is the perspective length of the line A between 1 and 2. If the student then rule a line from the point 2, making it pass through the point 3, and continue it up to the horizontal line, the point G, where it touches, will be the point of distance, and will regulate the perspective lengths of the squares on the line B.* The line A must now be divided

* It is immaterial whether the line B or the line D, each of which represents the perspective length of A, be taken for finding the perspective distances of the squares. If the student measure off to the right of the point 2 a space equal to the line A, between 1 and 2, and from its extremity, H, rule a line to the point of distance, it will intersect the line C at 4, the point determining the length of the line D by means of the horizontal line drawn from the point 3 of the line B.

into eight parts; and from each of the points of division, viz. 5, 6, 7, 8, 9, 10, 11, a line must be drawn to the vanishing point F. These lines represent the gradually decreasing width of the squares from A to C. From each of the same points — 5, 6, 7, 8, 9, 10, 11 — a line must be drawn to the point of distance, G; and where these lines intersect the line B, at the points *a*, *b*, *c*, *d*, *e*, *f*, *g*, they represent the gradual decreasing length of each square from A to C. From each of these points of intersection, *a*, *b*, *c*, &c., a line parallel to the line A must be drawn till it meet the line D; and these lines, by their intersections of those drawn from the points 1, 2, 3, &c., give the perspective representation of the whole 64 squares of the chess-board. The alternate squares are slightly shaded to make the figure perfectly intelligible to the juvenile student.

Here let it be understood, that when the four sides of the square A, B, C, D are put in perspective, if, in order to find a point of distance, a line had been ruled from the point 1 through the point 4, the point at which that line would touch the horizontal line would give a point of distance that would have produced the same result; observing, that in this case the points


S
H
G
T
J.W.Lowry fc.

of intersection, *a*, *b*, *c*, *d*, &c., would have come on the line D instead of the line B.

Problem III.

The student, in drawing this figure, must, according to the explanations given in Problem I., draw the nearest house, so far as it is described, up to the lines lettered to Q and figured to 8; observing that, with a view of exercising his ingenuity, the gable end is on the opposite side,—the letters and figures up to Q and 8 referring to similar lines in Problem I.

* In order to determine the perspective width of the second and third house, the same means might be used as employed for determining the position and width of the windows in Problem I., that is, a horizontal line might be drawn to the right of the point 1, the top of the line A, and from any part

* It must be understood that the description here commenced, and continued to the end of this and the following paragraph, is not the description of the mode by which the gables in this representation are drawn. It is given in order to impress on the mind of the reader what he has already done, and to accustom him to comprehend perspective drawing by general description. The student would do well, however, to draw the problem on a separate sheet, according to the description here given.

of the horizontal line to the left of the line E a point might be chosen as a point of distance, and from it a line drawn through the point 3 till it meet this horizontal line would give the geometrical width of the house between its point of contact and the point 1. If two similar spaces were measured off on this line to the right, to represent the geometrical width of the second and third houses, and from each of the points of division a line were drawn to the point of distance where these lines intersect the line C, would be the perspective widths of the second and third cottages. If the reader has thoroughly understood the first problem, he would now have no difficulty in putting the gables to these two further houses on the same principles as those used for drawing the first: but the author, in a long experience of teaching, has found so frequently that in the slightest variation in the application of a rule the juvenile student is apt to get bewildered; at the risk of being thought tedious, he will repeat the mode necessary for proceeding.

From each of the points of intersection on the line C that determine the perspective widths of the second and third cottages a perpendicular line should be drawn down to meet the line J; and these two

lines, with the portions of the lines C and J lying between them, would represent the rectangular parallelograms of the second and third cottages, answering to that contained by the lines A, C, E, J of the first. In each of these perspective parallelograms two diagonal lines should be drawn, corresponding with the lines L and M in the first; and from their points of intersection two perpendicular lines should be drawn to touch the line O, similar to the line N drawn from the point 7 to 9. The line O ruled from the point 8 to the vanishing point G fixes the height of the first gable: and as it is supposed that all three of the gables are of the same height, the line O would also determine the height of the gables of the second and third cottages; so that where the line O would meet the perpendicular lines just drawn would be the points where the two sides of the gable must meet. From each of these points to the top of the perpendicular lines right and left (corresponding to the points 1 and 3 of the first gable) draw the sides of the gables, corresponding to the lines P and Q of the first, and in a similar manner any number of cottages with gables may be continued on.

Where many gables follow in succession, as in a

long row of houses with gable ends, or with garret or other windows having pointed tops, there is a rule for putting them in perspective much more simple than the foregoing, the use of which, with a little extra attention, the student will fully comprehend. Let us suppose that on some part of the front of each of these cottages was fixed a clock-dial, and let us further suppose the time marked upon each dial to be a quarter to twelve: the hour-hand of the dial would then be perpendicular, (or so nearly so, that, for the sake of our lesson, we must grant it to be perpendicular,) and the minute-hand in a horizontal position. To represent a series of dials with the hands in this position would not require any additional points, because the hour-hands, being perpendicular, would be parallel to the other perpendicular lines on the face of the building; and the minute-hands, being horizontal, would be drawn to the same vanishing point as the other horizontal lines on the face of the building: but if, instead of the hands of the dials indicating the time a quarter to twelve, they stood at ten minutes to one, they would then be at an angle both with the horizontal and perpendicular lines of the building. It has been already remarked, that all lines that are *geometrically*

parallel are drawn in perspective to the same vanishing point. Now if the hands of all these dials stand precisely at ten minutes to one, all the minute-hands must be parallel to each other, and all the hour-hands must also be parallel, and certain points must be found by which the directions of the lines representing these hands may be drawn. The minute-hands of the dials pointing to the figure ten, the lines representing them must necessarily run upwards from the horizontal line, and some point must be found to represent them above it; but if, on the contrary, they pointed to the figure four, they would run downwards, and some point must be found to represent them below the horizontal line. These points are to be found on a line perpendicular to the horizontal line, either above or below it, and passing through the vanishing point.

As it would be with the hands of a series of dials just described, so is it with the lines corresponding with P and Q in a series of gables, these lines being at an angel both with the perpendicular and horizontal lines of the building and with each other. By finding the respective vanishing points for these two lines, the student will not only be enabled to find the perspective directions for an infinite number of

gables, but in drawing them they determine the perspective width of each building.

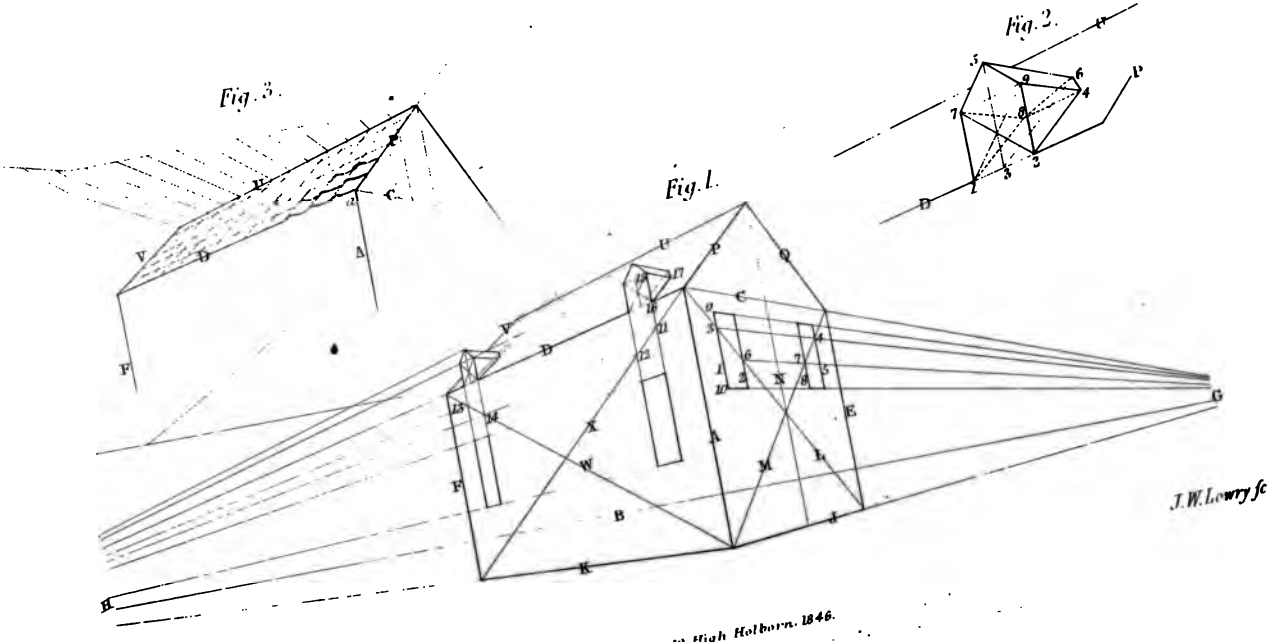
To proceed with the drawing, which we left with the first house completed, as in Prob. I. to the letter Q and figure 8. Through the vanishing point G a long line R must be drawn perpendicular to the horizontal line, above and below it; and the line P of the first gable must be continued upwards till it meet the line R at S, which will be the vanishing point for all the lines forming the left side of the gable, all of which lines the student is aware are geometrically parallel. The line Q, the second line of the first gable, must then be continued downwards till it meet the line R at T, which will be the vanishing point for all the lines forming the right side of the gable. From the point 3 a line must be drawn to the vanishing point S, which will give the perspective direction of the first line of the second gable: and where this line at 10 intersects the line O (which drawn from the point 8 regulates the height of each gable), it determines the point where the two lines of the second gable meet; and from it a line must be drawn to the vanishing point T, which gives the perspective direction of the second line of *the* second gable. Where this line intersects the

line C, which gives the perspective height of all the lines from which the lines of the gables are drawn, it determines the perspective width of the second cottage, and from it the third gable is drawn precisely as was the second from the point 3. By the same process a fourth, fifth, or more gables may be drawn, at the will of the artist: the three given are quite sufficient to enable the student to comprehend the rule. But one of the most important features of this mode of representing the gables is the facility and accuracy with which the perspective direction of the sloping line of the roof from the point 5 on F is drawn. It is a common error to draw this further line V parallel to the line P; but the student will readily perceive, from the example before him, as also by looking at nature, the inaccuracy of so doing—the further line V sloping much more than the line P. From the point 9, the point of the first gable, draw the line U to the vanishing point H; this gives the perspective direction of the upper line of the roof: then from the point 5 draw the line V to the vanishing point S; and where this line intersects the line U at 11 is a point corresponding to the point 9 on the line N. From each of the points of the second and third gables a line must be drawn to the

vanishing point H, to give the direction of the upper lines of the roofs of the respective cottages, which completes the drawing. These additional points, S and T, are found to be valuable in various ways, as will be shown in our progress onward: they greatly facilitate the finding the positions of chimneys or windows on sloping roofs of houses, of towers or spires on the sloping roofs of churches, &c.

. The student will perceive that diagonal lines are put on the gable end of each cottage, and that perpendicular lines have been drawn from their points of intersection (the perspective centres of each gable end). This is done to demonstrate to the student that the mode of finding the points of the gables by means of the two vanishing points S and T produces the same result as that of finding them by means of the diagonal lines; the perpendicular lines drawn from the intersections of the diagonals passing directly through the points of the gables found by the vanishing points S and T.

Prob. I. S



John Weale, 59 High Holborn. 1846.

Problem IV.

In a note in a former part of this work we drew the attention of the student to the advantage he would find from using the diagonal lines. In sketching from nature it is rarely possible — neither is it desirable— to have the actual measurement of the objects to be represented; most of the relative proportions of one object with another must depend on the eye of the artist: but if the position and form of any one object be carefully drawn on one part of the face of a building, the position and form of any similar object in a corresponding part may be found by means of the diagonal lines. The skeleton of the house is drawn in the same manner as in the last problem and Prob. I. For the advantage of having the references distinct, the figure is drawn rather larger; in consequence of which the vanishing points are out of the picture, but they are referred to in the first and third problems as G and H; and the student in making his drawing must necessarily have them. The points to which the figures referred in the former Problems, being unnecessary for our present purpose, are not marked; and the references by figures here given

relate only to the new rule about to be explained. The student must first, as before described (Prob. I.), draw all the lines of the house, with their letters A, B, &c. for reference, up to the letter Q, marking the respective vanishing points of each side, G and H. This done, he must sketch the position and size of the first window on the gable end of the house, and then with his T square draw correctly the lines 1 and 2, carrying them a little above and below the lines he has sketched for the top and bottom of the window. Now in order to get the relative distance of the second window from the line E that the first window is from the line A, it is necessary, from the point 3, where the line 1 intersects the diagonal line L, to draw a line to the vanishing point G. This line intersects the other diagonal line M at 4; and through this point of intersection 4 draw a perpendicular line 5. The point 4 on the diagonal M corresponds with the point 3 on the diagonal L, and the line 5 drawn through it is at the same relative distance from the line E that the line 1 of the first window is from the line A. To find the relative perspective width of the second window, from the point 6, where the line 2 of the first window intersects the diagonal L, another line must be drawn to the vanishing point G, and the

point where it intersects the diagonal M at 7 corresponds with the point 6 on the diagonal L; through this point 7 another perpendicular line (8) must be drawn, which corresponds with the line 2 of the first window, and the space between the lines 5 and 8 represents, relatively to its perspective distance, the same as that between the lines 1 and 2. The ruler must now be placed on the line 1, at that point denoting the top line of the window, as at 9, and from it a line must be ruled to the vanishing point G: this will correct the original sketched line of the first window; and when it passes between the lines 8 and 5 it will represent the top line of the second window. The ruler must now be placed at the point on the line 1, that denotes the position of the bottom line of the window; and from that point a line drawn to the vanishing point G will give, where it passes between the lines 1 and 2, the bottom line of the first window, and where it passes between the lines 8 and 5, the bottom line of the second.

In the first window, just drawn, the perpendicular lines forming the sides intersect the diagonal line L, as at 3 and 6; and consequently the corresponding points on the diagonal line M are found easily, by ruling at once from these points to the vanishing

point G. But it happens sometimes that the windows are so situated on the face of a building, that their sides neither intersect nor touch the diagonal lines. In order to point out the mode of proceeding when the windows are so situated, we will take the other side of the building. We will suppose a window to be in the situation of that represented in the engraving near the line A, between that line and F: this being sketched, the diagonal lines W and X must be drawn. The student will here perceive that neither of the upright lines of this window touch the diagonal lines; the student must therefore, with his T square, continue them upwards till they meet the diagonal line X at the points 11 and 12, and from each of these points draw a line to the vanishing point H. Where the upper line intersects the diagonal line W at 13 is a point corresponding with the point 11 on the diagonal line X, and where the lower line intersects the diagonal line W at 14 is the point corresponding with the point 12 on the diagonal line X. From each of these points (13 and 14) a perpendicular line must be drawn downwards, and the space between these two lines represents the perspective width of the second window, at its perspective distance from the line F, corresponding with the distance of the first window,

from the line A. The upper and lower lines of the second window are found, as on the other side of the house, by continuing the lines of the top and bottom of the first window to the vanishing point H.

Let us now suppose that on the roof there are two garret windows, situated immediately over the two windows just drawn, of the same width, and each window having a pointed roof. To find their width and position the upright lines of the windows just drawn must be continued up through the line D, which will form their sides. Let any point on the nearest of these upright lines be chosen, as at 15, to fix their height (the mode for getting a fixed height would be the same as that explained for getting the height of the gables, Problem I., 8, O), and from it rule a line to the vanishing point H; this, crossing the upright lines already drawn, will give the rectangular parallelograms of the garret windows in perspective: and as there are only two garret windows, and consequently only two pointed roofs, to be drawn, the readiest way will be to find the situation of the points by raising perpendicular lines from the intersection of the diagonal lines of each parallelogram. The pointed roofs of these two windows are here drawn, and the lines used for finding them left; but

it would be quite superfluous again to go over the explanation of drawing them. In order to find the side of the first garret window it is necessary first to draw a line from the point of the gable to the vanishing point G, as also from the point 15 to the same vanishing point, which lines will represent the perspective direction of the upper and lower lines of the roof of the garret window, — and which the student must understand, in the real object, are parallel to the horizontal lines on the gable side of the house. To find the points where these two lines terminate on the roof of the house will require a little attention: the rule is similar to that employed for finding the directions of the gables in Problem III. The student must first find the vanishing point for the line P of the gable of the house. The lines of each of the sides of these windows, where they touch the roof, are in reality parallel to the line P of the gable (because the whole side of the roof is a uniform slope), and must consequently vanish to the same point; therefore from the point 16, where the upright line of the window touches the lower line of the roof of the house, a line must be drawn to the vanishing point S; and where this line intersects that *drawn from* the point 15 to the vanishing point G

at 17, is the point marking the spot where the lower line of the roof of the garret window touches the sloping roof of the house. To find the point where the upper line of the roof of the garret window touches the sloping roof of the house, is a little complicated; and to render it quite clear, an additional figure is introduced. *Fig.* 2. is drawn up to the point marked 17. of *fig.* 1. The window here drawn contains the lines of both sides, as if it were transparent. The student will observe that the point of the front of the gable comes directly on a line, exactly midway (perspectively) between the two sides; consequently, the point at the back must come on a line midway between the sloping lines on the roof forming the two sides; from the points 3 and 1, two lines have been drawn towards the vanishing point S. Where the line drawn from the point 3 meets the line drawn from the point of the gable 5 to the vanishing point G at 6, is the point where the two roofs join; and a line drawn from the point 6 to 4 will complete the drawing of the first garret window. The student will observe, that where the line drawn from the point 1 to the vanishing point S intersects the line drawn from the point 7 to the vanishing point G at 8, the lines forming

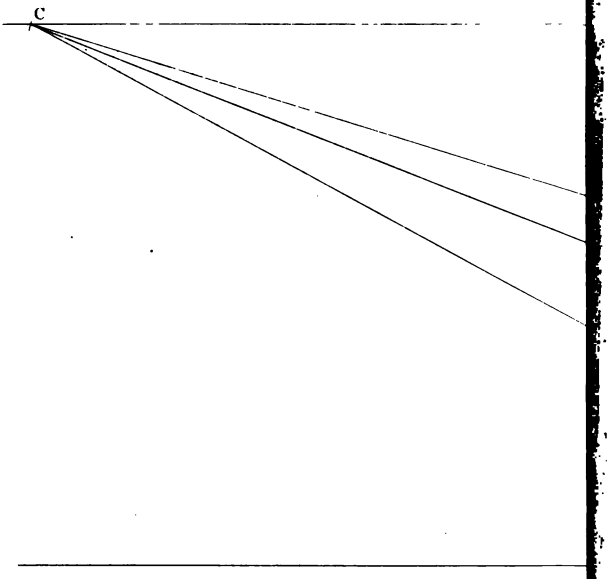
the triangle 1, 7, 8, represent the farther side of the window, and correspond with the lines forming the triangle 2, 9, 4, the near side; the lines forming the triangle 4, 8, 6, represent the form of the gable on the sloping roof of the house, and correspond with the lines forming the triangle 7, 5, 9. The garret windows in the drawing *fig.* 1. must now be completed, in the manner described in *fig.* 2., and the highest line of the roof of the house, U, with the extreme line of the slope, V, drawn to their respective points, as in the preceding problem (III.), and this figure will be finished.

The rules given in this and the preceding plate will be found useful for drawing the divisions of tiles or slates on the roof. In *fig.* 3. that position only of the drawing of the house is introduced necessary for the purpose. The lines A, C, D, F, P, U, V, are drawn as before described. From the point of the gable a horizontal line must be drawn to the left, to represent the geometrical length of the perspective line U; this geometrical line must be divided into as many equal parts as there are tiles in each row, and a point of distance found, to give the perspective positions of these several divisions on the *line* U. These being found, a line must be drawn

through each from the vanishing point S to the line D, which will give the correct perspective direction of the divisions of the tiles or slates. From the point *a* a horizontal line must be drawn to the right, to represent the geometrical length of the near half of the line C, and this geometrical line must be divided into as many equal parts as there are rows of tiles on the roof, and a point of distance found to get the perspective positions of these points on the near half of the line C. These divisions, however, are required on the line P, and from each point of intersection on C a perpendicular must be drawn till it touch the line P, and from each point of contact a line must be drawn to the vanishing point H, which, by their intersections with the lines drawn between U and D, give the relative forms and positions of the different tiles; as the lines crossing each other in Prob. II. represent the 64 squares of the chess-board. The tiles may be of various forms; but we do not attempt to do more at present than point out the mode of finding the perspective distances. The student may easily, on these, draw any form of tile that may happen to have been used, as in the example just given.

The rules employed in this problem will be found

that he would have no difficulty in finding the width of each arch, the width of each column, pilaster, or pier between the arches, and their gradations of height. All this can be accomplished by the use of a common ruler, because it can be done by means of straight lines: but no ruler has yet been invented that will enable the student to draw the changes of forms taken by the curves in perspective. The mode of proceeding is, first to draw geometrically the curve intended to be represented in perspective, and through this geometrical figure to draw in certain directions various straight lines, that shall intersect or touch one another in certain points of the curve; to put these straight lines in perspective, which will change the relative positions of the various points, and through them, by hand, to draw the curve in perspective, as, for instance (*fig.* 17.). In this diagram we have a circle drawn; and in order to find certain points in this circle, that will enable us to put it in perspective, it is enclosed in a square; and the student will perceive that the circle touches at four points of this square, exactly at the points of contact of the two cross lines. Nothing can be more simple than to put the six straight lines of this diagram in perspective; which, when done, would furnish four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points, through which the curve line forming the circle in perspective must be drawn. But four points are not found sufficient for the representation of a circle in perspective; we must therefore find some additional points, by adding to the straight lines already drawn two diagonal lines (*fig.* 18.).—The student will here observe that these diagonal lines intersect the line of the circle at four other points, exactly midway between those in the former diagram. Let us now proceed to construct the figure.

Problem V.

The student ought now, without assistance, to be able to put in perspective the square, the diagonal lines, and the perpendicular and horizontal lines that pass through the centre; but that no error may by possibility occur, we will give him a little aid. First, below the ground line, of any size that may be required, he must construct a geometrical figure similar to the second diagram given in the preceding paragraph, and, taking the upper line of the square of this diagram for his first line, draw the square in perspective*; then from the opposite corners draw

* By referring to the drawing of the chess-board, Problem II., the manner of drawing the square in perspective will be found.

the two diagonal lines: from the point 1 draw a line to the vanishing point, and through the centre of the square (where the diagonal lines intersect) draw a horizontal line across, from the line D to the line E, to the points 4 and 2. The student will here perceive that he has put in perspective the straight *lines* contained in the second diagram above, and found the four *points* contained in the first; viz., the points marked 1, 2, 3, 4 of the geometrical drawing here given. It was observed, in the foregoing paragraph, that certain straight lines must be drawn, that shall intersect or touch one another at certain points of the curve, &c. Now the student will perceive that the diagonal lines drawn in the second diagram, though they intersect the line of the circle, have no points of intersection with any other straight lines, and that therefore these diagonal lines in the perspective drawing in this stage are quite useless: in order, therefore, to find the points where the diagonal lines intersect the circle, we must have two additional straight lines. In the square of the geometrical drawing on each side, through the points where the diagonals intersect the circle, draw a line running from the top to the bottom line of the square, as the line A passing through the points 6 and 7, and

touching the bottom line of the perspective square at 9, and the line B passing through the points 5 and 8, and touching the bottom line of the perspective square at 10. From each of these points 9 and 10 a line must be drawn to the vanishing point; and where the line drawn from the point 9 intersects the first diagonal, it gives a point corresponding with the point 6 in the geometrical drawing; where it intersects the second diagonal line, it gives a point corresponding with the point 7. In like manner the line drawn to the vanishing point from the point 10, at its intersections with the diagonal lines, gives two points corresponding with the points 5 and 8 of the geometrical drawing.

The perspective positions of the whole of the eight points being thus found, the student must carefully draw the curve to represent the circle, touching the points 1, 2, 3, 4, and passing through the points 5, 6, 7, 8. This mode is generally found sufficient for all ordinary purposes; but where circles are required to be drawn in perspective of very large dimensions, more points of intersection may be found in the geometrical drawing: these do not at all increase the difficulty; on the contrary, the curve line is drawn with more ease and accuracy; but the mul-

tiplicity of lines would be apt to puzzle the student, and, as we before remarked, the foregoing is quite sufficient for all ordinary purposes.

Let us suppose that the circle just drawn represents the spot on which a column is to be erected, and that a row of these columns is to be built; that the columns are to be distant from each other exactly their own width, and that the circle is marked on each spot where a column is to be erected. In order to represent this in perspective, it is first necessary to find a point of distance: this must be done by the same rule employed in Problem II. (the finding the point G). The student must first find the proper distance for, and afterwards draw, the perspective square in which the circle is to be drawn. To find the distance, he must measure off on the ground line, and on the opposite side to where he has fixed his point of distance, two spaces of the width of the geometrical square; and from each point of division, 11 and 12, a line must be drawn to the point of distance C. Where the line drawn from the point 11 intersects the line D at 13, it gives the perspective distance between the two circles; and where the line drawn from the point 12 intersects the line D at 14, the space between that point and the point 13 repre-

sents the left side of the square in perspective in which the second circle is to be drawn. From the points 13 and 14 two horizontal lines must be drawn to touch the line E at the points 15 and 16. These two lines, with the portions of the lines D and E between their extremities, form the four sides of the square in perspective in which the second circle is to be drawn. From the points 13 to 16 and 14 to 15 draw two diagonal lines, and through their points of intersection draw a horizontal line between the lines D and E. The line running from the point 1 of the first square, in passing through the bottom and top lines of the second, gives the points corresponding to the points 1 and 3 in the first. The line running from the point 9 of the first square, where it intersects the diagonals of the second, gives the points corresponding with the points 6 and 7 of the first: in like manner, the line running from the point 10, at its intersections with the diagonal lines of the second square, gives the points corresponding with those marked 5 and 8 in the first; and the horizontal line, passing through the centre of the second square, gives, at its points of contact with the lines D and E, points corresponding with the points 4 and 2 in the first. The whole of the eight points being thus

found in the second square, it remains only, as before described, to draw the curve line through them, which will represent the perspective position and form where the base of the second column is to be placed. By continuing in this manner, a third, fourth, or any number of circles may be drawn at their perspective distances: the two given are quite sufficient to illustrate the rule.

It may here be well to remark, that every circle correctly drawn in perspective forms a perfect ellipse, whether, from the position from which it is viewed, it appear broad or narrow. By those who understand perspective but imperfectly, this is frequently denied; and their disbelief arises from their mistaking the middle horizontal line for the axis of the ellipse, whereas it simply divides the circle into its *perspective* halves. If all the lines serving to draw the curve were to be erased and the curve left; if its proper axis (a long straight line, that divides it longitudinally into two equal parts,) were to be found, it would show that the curve forms a true ellipse.

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